7. CLAIMS

What is claimed is:

1. A method of inductive learning comprising:
receiving training data;
providing vectors having a set of parameters based on said training data; and
generating a cluster database comprising clusters, said clusters being associated with respective ranges of values for at least a subset of said set of parameters.

2. The method of claim 1 wherein said subset of said set of parameters is said set of parameters.

3. The method of claim 1 further comprising:
supplying, by a data acquisition module, said training data.

4. The method of claim 1 wherein said training data comprises archived data.

5. The method of claim 1 wherein said training data comprises simulated nominal data.

6. The method of claim 1 wherein said training data comprises off-nominal data.

7. The method of claim 1 further comprising:

scaling said training data associated with at least one parameter of said set of parameters.

8. The method of claim 1 wherein said generating comprises:

determining a distance between one of said vectors and one of said clusters, and

producing a new cluster if said distance exceeds a threshold value.

9. The method of claim 1 wherein said generating comprises:

determining a distance between one of said vectors and one of said clusters, and

expanding said one of said clusters to include said vector when said distance is less than or equal to a threshold value.

10. The method of claim 1 further comprising:

indexing said clusters of said cluster database based on a distance of each of said clusters from a predetermined indexing reference point, and

organizing said clusters into a data structure based on said indexing.

11. A method of monitoring a system comprising:

providing a cluster database comprising clusters, said clusters being associated with respective ranges of

values for at least a subset of a set of cluster parameters;

receiving one or more monitored-system vectors having monitored-system parameters; and

determining whether said monitored-system vector is contained in one of said clusters based on at least a subset of said monitored-system parameters and said at least a subset of said cluster parameters.

12. The method of claim 11 further comprising:

if one of said monitored-system vectors is not contained in one of said clusters, determining a distance of said one monitored-system vector from a nearest of said clusters, wherein said distance is associated with a severity of a deviation.

13. The method of claim 12 wherein said determined distance provides a comparison result for each monitored-system vector, further comprising:

supplying said monitored-system vectors and said comparison result associated therewith to another learning application.

14. The method of claim 11, further comprising:

examining said monitored-system vectors to determine if any parameter is erroneous; and

if any parameter of one of said monitored-system parameters is erroneous, adjusting said erroneous parameter such that said parameter will match any range

specified for said parameter in any cluster of said cluster database.

15. The method of claim 11 further comprising:

providing an additional cluster database, the clusters of said additional cluster database being associated with respective ranges of values for at least a subset of said set of parameters, said additional cluster database being annotated with diagnostic information; and

if one of said monitored-system vectors is not included in one of said clusters, comparing said one of said monitored-system vectors with said clusters of said additional cluster database.

16. An article of manufacture comprising a computer program usable medium embodying one or more instructions executable by a computer for performing a method of inductive learning, the method comprising:

receiving training data;

providing vectors having a set of parameters based on said training data; and

generating a cluster database comprising clusters, said clusters being associated with respective ranges of values for at least a subset of said set of parameters.

17. The article of manufacture of claim 16 wherein said subset of said set of parameters is said set of parameters.

18. The article of manufacture of claim 16, said method further comprising:

supplying, by a data acquisition module, said training data.

19. The article of manufacture of claim 16 wherein said training data comprises archived data.

20. The article of manufacture of claim 16 wherein said training data comprises simulated nominal data.

21. The article of manufacture of claim 16 wherein said training data comprises off-nominal data.

22. The article of manufacture of claim 16, said method further comprising:

scaling said training data associated with at least one parameter of said set of parameters.

23. The article of manufacture of claim 16 wherein said generating the cluster database comprises:

determining a distance between one of said vectors and one of said clusters, and

producing a new cluster if said distance exceeds a threshold value.

24. The article of manufacture of claim 16 wherein said generating a cluster database comprises:

determining a distance between one of said vectors and one of said clusters, and

expanding said one of said clusters to include said vector when said distance is less than or equal to a threshold value.

25. The article of manufacture of claim 16, wherein said method further comprises:

indexing said clusters of said cluster database based on a distance of each of said clusters from a predetermined reference point.

26. An article of manufacture comprising a computer program usable medium embodying one or more instructions executable by a computer for performing a method of monitoring a system, the method comprising:

receiving one or more monitored-system vectors having monitored-system parameters; and

determining whether said monitored-system vector is contained in a cluster of a cluster database comprising a set of clusters, said clusters of the set being associated with respective ranges of values for at least a subset of a set of cluster parameters, said determining being based on at least a subset of said monitored-system parameters and said at least a subset of said cluster parameters.

27. The article of manufacture of claim 26, wherein said method further comprises:

if one of said monitored-system vectors is not contained in one of said clusters, determining a distance of said one monitored-system vector from the nearest of said clusters, wherein said distance is associated with a severity of a deviation.

28. The article of manufacture of claim 27 wherein said determined distance provides a comparison result for each monitored-system vector, said method further comprising:

supplying said monitored-system vectors and said comparison result associated therewith to another learning application.

29. The article of manufacture of claim 26, wherein said method further comprises:

if any parameter of one of said monitored-system parameters is erroneous, adjusting said erroneous parameter such that said parameter will match any range specified for said parameter in any cluster of said cluster database.

30. The article of manufacture of claim 26, wherein said method further comprises:

if one of said monitored-system vectors is not included in one of said clusters, comparing said one of said monitored-system vectors with clusters of an additional cluster database, said clusters of said additional cluster database being associated with respective ranges of values for at least a subset of said

set of parameters, said additional cluster database being annotated with diagnostic information.

31. An apparatus for inductive learning comprising:

a computer; and

one or more computer programs, executed by said computer, for:

receiving training data;

providing vectors having a set of parameters based on said training data; and

generating a cluster database comprising clusters, said clusters being associated with respective ranges of values for at least a subset of said set of parameters.

32. The apparatus of claim 31 wherein said subset of said set of parameters is said set of parameters.

33. The apparatus of claim 31, wherein said one or more computer programs also for:

supplying, by a data acquisition module, said training data.

34. The apparatus of claim 31 wherein said training data comprises archived data.

35. The apparatus of claim 31 wherein said training data comprises simulated nominal data.

36. The apparatus of claim 31 wherein said training data comprises off-nominal data.

37. The apparatus of claim 31, wherein said one or more computer programs also for:

scaling said training data with at least one parameter of said set of parameters.

38. The apparatus of claim 31 wherein said generating comprises:

determining a distance between one of said vectors and one of said clusters, and

producing a new cluster if said distance exceeds a threshold value.

39. The apparatus of claim 31 wherein said generating comprises:

determining a distance between one of said vectors and one of said clusters, and

expanding said one of said clusters to include said vector when said distance is less than or equal to a threshold value.

40. The apparatus of claim 31, wherein said one or more computer programs, executed by said computer, further comprises, for:

indexing said clusters of said cluster database based on a distance of each of said clusters from a predetermined indexing reference point.

41. An apparatus for monitoring a system, comprising:

a computer having a memory storing a cluster database comprising clusters, said clusters being associated with respective ranges of values for at least a subset of a set of cluster parameters; and

one or more computer programs, executed by said computer, for:

receiving one or more monitored-system vectors having monitored-system parameters; and

determining whether said monitored-system vector is contained in one of said clusters based on at least a subset of said monitored-system parameters and said at least a subset of said cluster parameters.

42. The apparatus of claim 41, said determining also for, if one of said monitored-system vectors is not contained in one of said clusters, said determining determines a distance of said one monitored-system vector from the nearest of said clusters, wherein said distance is associated with a severity of a deviation.

43. The apparatus of claim 42 wherein said determined distance provides a comparison result for each monitored-system vector, said one or more computer programs further comprising:

supplying the monitored-system vectors and their associated comparison result to another learning application.

44. The apparatus of claim 41, said one or more computer programs also for examining said monitored-system vectors, and, if any parameter of one of said monitored-system vectors is erroneous, said examination adjusts said erroneous parameter such that said parameter will match any range specified for said parameter in any cluster of said cluster database.

45. The apparatus of claim 41, wherein said memory also stores an additional cluster database, the clusters of said additional cluster database being associated with respective ranges of values for at least a subset of said set of parameters, said additional cluster database being annotated with diagnostic information; and

wherein, if one of said monitored-system vectors is not included in one of said clusters, said determining compares said one of said monitored-system vectors with said clusters of said additional cluster database.